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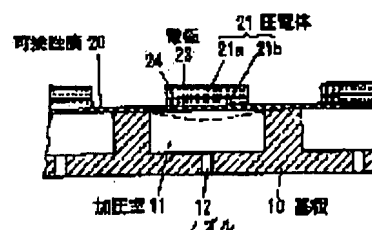
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(54) PIEZOELECTRIC TYPE INK JET HEAD

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a piezoelectric type ink jet head not generating the deterioration of characteristics caused by residual stress at a time of bonding and good in the displacement efficiency of piezoelectric elements.

SOLUTION: This ink jet head is equipped with a substrate 10 having a plurality of pressure chambers 11, the flexible film 20 constituting one wall surfaces of the pressure chambers 11 and the piezoelectric elements 21 bonded and fixed on the pressure chambers 11 and having a laminated structure consisting of two or more layers. The ink in the respective pressure chambers 11 is pressurized by the bending displacement of the piezoelectric elements and emitted from nozzles 12. The flexible film 20 functions as a protective film preventing the penetration of ink into the piezoelectric elements 21 and the deterioration of ink caused by voltage applied to the piezoelectric elements 21.



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CLAIMS

[Claim(s)]

[Claim 1] the substrate with which two or more pressurized rooms were formed, the nozzle prepared in each pressurized room, the flexible film which fixes on a substrate and constitutes one wall surface of a pressurized room, and the piezo electric crystal of the laminated structure more than two-layer [by which junction immobilization was carried out on the flexible film] -- having -- crookedness of the above-mentioned piezo electric crystal -- the piezo-electric mold ink-jet head which constituted so that the ink in each pressurized room might be pressurized with a variation rate and ink might be made to breathe out from a nozzle.

[Claim 2] At least one layer of the above-mentioned piezo electric crystal is a piezo-electric mold ink jet head characterized by being the layer in which an electrical potential difference is not impressed in a piezo-electric mold ink jet head according to claim 1 at the time of a drive.

[Claim 3] The piezo-electric mold ink jet head characterized by forming the displacement section which plurality became independent of by joining a piezo electric crystal superficially on the above-mentioned flexible film, and establishing a slot in the piezo electric crystal on the side attachment wall of each pressurized room in a piezo-electric mold ink jet head according to claim 1 or 2.

[Claim 4] The piezo-electric mold ink jet head characterized by forming the displacement section which plurality became independent of by joining a piezo electric crystal superficially on the above-mentioned flexible film, and establishing a slot in the piezo electric crystal on the center section of each pressurized room in a piezo-electric mold ink jet head according to claim 1 or 2.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to a piezo-electric mold ink jet head, especially the ink jet head of a multi-nozzle mold.

[0002]

[Description of the Prior Art] As this kind of an ink jet head, the multi-nozzle head which accumulated many pressurized rooms is known as indicated by JP,58-102775,A, for example. This head is what carried out laminating adhesion of a diaphragm and the piezo electric crystal on the substrate in which the pressurized room was formed, PZT system electrostrictive ceramics is used for a piezo electric crystal, and a hard ingredient like ABS plastics is used for the diaphragm.

[0003] the crookedness with which the piezo electric crystal and the diaphragm were united in order to have carried out the regurgitation of the ink in a pressurized room from the nozzle -- a variation rate is required. In order to generate crookedness displacement efficiently, the diaphragm itself is hard to some extent, and a piezo electric crystal and the thickness more than comparable are desirable.

[0004]

[Problem(s) to be Solved by the Invention] By the way, generally a piezo electric crystal and a diaphragm have many which are unified by the heating adhesion by epoxy system adhesives etc. However, since residual stress arose in the deformation and the interior by the differential thermal expansion, flexion deformity was checked and property degradation of the discharge direction of ink becoming unstable had occurred. moreover -- if the thickness of a diaphragm is thick -- crookedness -- it spread to the next pressurized room, or the problem of the deformation of a diaphragm itself being checked for a variation rate through the joint of a substrate and a diaphragm occurred.

[0005] Then, the purpose of this invention is to offer the piezo-electric mold ink jet head which can cancel the above troubles.

[0006]

[Means for Solving the Problem] the flexible film which this invention fixes on the substrate with which two or more pressurized rooms were formed, the nozzle prepared in each pressurized room, and a substrate, and constitutes one wall surface of a pressurized room in order to attain the above-mentioned purpose, and the piezo electric crystal of the laminated structure more than two-layer [by which junction immobilization was carried out on the flexible film] -- having -- crookedness of the above-mentioned piezo electric crystal -- the ink in each pressurized room pressurizes with a variation rate, and it constitutes so that ink may make breathe out from a nozzle.

[0007] In this invention, the flexible film does not function as a diaphragm, but ink permeates a piezo electric crystal side, or it functions as a protective coat which prevents that ink deteriorates with the applied voltage to a piezo electric crystal. therefore, the flexible film -- the variation rate of a piezo electric crystal -- following in footsteps -- easy -- bending -- fundamental -- the piezo electric crystal of a laminated structure -- crookedness -- since the variation rate is possible -- crookedness -- there is no problem of a variation rate spreading to the next pressurized room, or checking deformation of a piezo electric crystal. Moreover, since residual stress does not occur inside when a piezo electric crystal and the flexible film are joined, there is no property degradation like structure before which joined the diaphragm and the piezo electric crystal.

[0008] As flexible film, ingredients, such as resin film, and a metal membrane, rubber membrane, are not asked compared with a piezo electric crystal that what is necessary is just a soft ingredient. Preferably, membranous thickness is 1/2 or less [of a piezo electric crystal], and the Young's modulus of 1/2 or less thing of a piezo electric crystal is desirable.

[0009] For example, in the case of the piezo electric crystal of a two-layer laminated structure, one side is the direction of polarization, and this direction, and another side can also be considered as the so-called bimorph type which impresses an electrical potential difference to hard flow of piezo electric crystal. However, in this case, when the electrical potential difference of hard flow is impressed, polarization reversal arises, both layers become the driver voltage in the same direction, and property degradation accompanying the so-called polarization degradation from which crookedness displacement stops arising arises. on the other hand, the layer of others when at least one layer of a piezo electric crystal is used as the layer which is not impressed to an electrical potential difference at the time of a drive -- the electrical potential difference for a drive of the same direction as the time of polarization -- impressing -- crookedness -- compared with a bimorph mold, property degradation accompanying polarization degradation can be lessened by producing a variation rate.

[0010] It is desirable by joining a piezo electric crystal superficially on the flexible film, and establishing a slot in the piezo electric crystal on the side attachment wall of each pressurized room to form the displacement section which plurality became independent of. In this case, since the displacement section can be formed by mechanical recessing, compared with the case where each piezo electric crystal is joined to the flexible film, highly-precise-izing and low cost-ization is realizable.

[0011] Furthermore, when the displacement section which plurality became independent of by joining a piezo electric crystal superficially on the flexible film, and establishing a slot in the piezo electric crystal on the center section of each pressurized room is formed, so to speak, a piezo electric crystal serves as cantilevered suspension structure, and the large amount of displacement of a piezo electric crystal can be taken.

[0012]

[Embodiment of the Invention] Drawing 1 and drawing 2 show the 1st example of the piezo-electric mold ink jet head concerning this invention. On a substrate 10, epoxy system adhesives etc. are used for this head, and it carries out the junction unification of the flexible film 20 and the piezo electric crystal 21. The substrate 10 consists of ingredients, such as a piezo electric crystal 21 and 42nickel alloy which has the approximated coefficient of thermal expansion, and two or more abbreviation rectangular pressurized rooms 11 by technique, such as photo etching, are formed in the top face. The nozzle 12 is formed in the pars basilaris ossis occipitalis by the side of the end of each pressurized room 11, and these nozzles 12 are located in a line with the single tier. In addition, the arrays or configurations of a pressurized room 11 and a nozzle 12 are not limited to drawing 1, and can be changed variously.

[0013] The flexible film 20 consists of PET (polyethylene terephthalate) films 10 micrometers or less, and constitutes one wall surface of a pressurized room 11. A piezo electric crystal 21 is really calcinated, after thickness carries out the laminating of upper 21a and lower layer 21b which are 15 micrometers. These piezo electric crystals 21a and 21b are constituted from PZT system ceramics by each, and are joined on the flexible film 20 on a pressurized room 11. The width method of a piezo electric crystal 21 is narrow a little than the width of face of a pressurized room 11, and the both ends of the longitudinal direction of a piezo electric crystal 21 are supported with the substrate 10 through the film 20. The electrodes 23 and 24 for a drive are formed between the top face of upper 21a of a piezo electric crystal 21, and the vertical layers 21a and 21b.

[0014] Although what is necessary is just to have polarized upper 21a at least in the above-mentioned example since upper 21a was used as a piezo electric crystal and lower layer 21b is used as a diaphragm, lower layer 21b may also carry out polarization processing. Moreover, lower layer 21b can be used as a piezo electric crystal, and upper 21a can also be used as a diaphragm. In this case, what is necessary is just to form the electrodes 23 and 24 for a drive in the vertical side of lower layer 21b.

[0015] There are the approach of carrying out junction immobilization of the piezo electric crystal 21 beforehand formed according to the individual on the flexible film 20 as the formation approach of the piezo electric crystal 21 of this example, an approach recessing separates the piezo electric crystal 21 superficially joined on the film 20, the approach of piercing the part equivalent to the slot of the piezo electric crystal 21 of a green sheet condition, etc.

[0016] If the electrical potential difference of the same direction as the direction of polarization of upper 21a is impressed between an electrode 23 and 24, upper 21a carries out crookedness displacement, and in connection with this, the piezo electric crystal 21 of a laminated structure can carry out crookedness displacement, and can carry out the regurgitation of the ink in a pressurized room 11 to the cross direction (a broken line shows to drawing 2) and the longitudinal direction of a pressurized room 11 from a nozzle 12. Although a mutual intervention tends to happen between the ***** piezo electric crystals 21 and between pressurized rooms 11 crosswise at this time, since the flexible film 20 intervenes between piezo electric

crystals 21, distortion is absorbed by the flexible film 20 and a mutual intervention cannot happen easily between the ***** piezo electric crystals 21 or between pressurized rooms 11. And since the flexible film 20 follows in footsteps of the variation rate of a piezo electric crystal 21 and bends easily, the variation rate of a piezo electric crystal 21 is not checked, but displacement effectiveness is good. moreover, upper 21a -- an electrical potential difference -- impressing -- crookedness -- when a variation rate is generated, one side is the direction of polarization, and this direction, and another side has the description that little property degradation accompanying polarization degradation is, compared with the so-called bimorph type which impresses an electrical potential difference to hard flow of piezo electric crystal.

[0017] Drawing 3 shows the 2nd example of this invention, gives the same sign to the same part as drawing 2, and omits explanation. This example does not carry out division formation of the piezo electric crystal 21, but joins it superficially the whole surface on the flexible film 20. The electrodes 23 and 24 for a drive are formed in the location corresponding to a pressurized room 11 at the top face of upper 21a, and the interlayer of the vertical layers 21a and 21b, respectively. A bipolar electrode 24 is used as a common electrode, by using the top-face electrode 23 as an individual electrode, you may pull out outside, the top-face electrode 23 may be used as a common electrode, and you may pull out outside by using a bipolar electrode 24 as an individual electrode. Moreover, electrodes 23 and 24 may be formed in the vertical side of lower layer 21b.

[0018] As a means to connect a bipolar electrode 24 outside, a through hole can be used or how to pull out an electrode from a side face can be considered. Also in this case, only upper 21a may be polarized among the vertical layers 21a and 21b, and both layers may be polarized. Moreover, it is possible by forming the thin film electrode in the flexible film 20 beforehand to extend the degree of freedom of the drawer approach of an electrode or the drive approach. For example, it is also possible to form a through hole in piezo electric crystal 21b by the side of a lower layer, and to pull out a bipolar electrode 24 from the thin film electrode on the flexible film 20.

[0019] This example not only also has the same effectiveness as the 1st example, but while the cash drawer of electrodes 23 and 24 becomes easy by forming a piezo electric crystal 21 all over the flexible film 20, recessing becomes unnecessary and it becomes easy to manufacture [of a head] it. And since the whole surface of the flexible film 20 is covered with a piezo electric crystal 21, the endurance of the film 20 can be raised.

[0020] Drawing 4 shows the 3rd example of this invention, gives the same sign to the same part as drawing 2, and omits explanation. This example carries out division formation of the displacement section by forming a slot 25 in the piezo electric crystal 21 on the side attachment wall 13 of a pressurized room 11, after forming a piezo electric crystal 21 superficially the whole surface on the flexible film 20 like the 2nd example.

[0021] It is formed of machining by dicing, and it is broader than the thickness of the side attachment wall 13 of a pressurized room 11, and it is [the depth (for example, 25 micrometers) is deeper than the thickness of upper 21a, and] shallower than the sum (for example, 30 micrometers) of the thickness of the vertical layers 21a and 21b. [of the above-mentioned slot 25] Therefore, although a part of lower layer 21b remains in the pars basilaris ossis occipitalis of a slot 25, since the flexible film 20 is thin enough and it is soft, even if a part of lower layer 21b remains, there are no worries about the mutual intervention between the ***** pressurized rooms 11, and there is no possibility that at least browning may reduce effectiveness. When the slot 25 was deeply cut by 1/2 or more Fukashi of a piezo electric crystal 21 according to the experiment of this invention persons, there was sufficient effectiveness.

[0022] In the conventional case, it is necessary to carry out recessing by dicing etc. also to a diaphragm with bad workability compared with a piezo electric crystal, and recessing becomes comparatively easy to having needed time amount seriously by the approach of forming the slot 25 of extent which does not result in the flexible film 20 as mentioned above, and it can be processed in a short time.

[0023] Drawing 5 shows the 4th example of this invention, gives the same sign to the same part as drawing 2, and omits explanation. This example carries out division formation of the displacement section by forming a slot 26 in the piezo electric crystal 21 on the center section of the pressurized room 11, after forming a piezo electric crystal 21 superficially the whole surface on the flexible film 20 like the 2nd example. In addition, although the slot 16 of this example is formed in the depth in which even the flexible film 20 results and the piezo electric crystal 21 two-layer whole is divided completely, it may leave a part like drawing 4. Although the electrodes 23 and 24 for a drive are formed between the top face of upper 21a of a piezo electric crystal 21, and the vertical layers 21a and 21b, these electrodes 23 and 24 are also divided into right and left by the above-mentioned slot 26. Top-face electrode 23 comrades of the Uichi Hidari group divided by the slot 16 and bipolar electrode 24 comrades have connected too hastily, respectively.

[0024] In the case of this example, on the side attachment wall 13 of a pressurized room 11, the cantilevered

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the top view of the 1st example of the ink jet head concerning this invention.

[Drawing 2] It is the A-A line sectional view of drawing 1 .

[Drawing 3] It is the sectional view of the 2nd example of the ink jet head concerning this invention.

[Drawing 4] It is the sectional view of the 3rd example of the ink jet head concerning this invention.

[Drawing 5] It is the sectional view of the 4th example of the ink jet head concerning this invention.

[Description of Notations]

1 0 Substrate

11 Pressurized Room

12 Nozzle

20 Flexible Film

21 Piezo Electric Crystal

23 24 Electrode

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